

WHAT IS CLAIMED IS:

1. A speech communication apparatus for bi-directional speech communications, comprising:
 - a speaker;
 - a microphone;
 - background sound level measurement means for extracting background sound from the output of the microphone and for measuring the level of the extracted background sound; and
 - received-speech clarifying means for adjusting a gain for the received speech to be output to the speaker according to the level of the background sound measured by the background sound level measurement means.
2. The speech communication apparatus of Claim 1, further comprising:
 - received-speech-level measurement means for measuring the level of a received-speech signal received in the speech communications at each predetermined frequency band,
 - wherein the background sound level measurement means measures the level of the background sound in each predetermined frequency band and the received-speech clarifying means performs loudness compensation in which the gain for the received-speech signal is adjusted in each predetermined frequency band such that the received speech is heard at almost the same intensity in the human auditory sense irrespective of the level of the background sound, and the resultant signal is output to the speaker as the received speech.
3. The speech communication apparatus of Claim 1, wherein the speech communication apparatus is a portable, mobile telephone for performing the speech communications by radio communication.
4. A speech communication apparatus for bi-directional speech communications, comprising:
 - a speaker;
 - a microphone;

background sound level measurement means for manipulating the frequency characteristic of the output of the microphone to minimize the proximity effect produced in the output of the microphone to extract speech to be transmitted from the output of the microphone, and for measuring the level of background sound according to the extracted speech to be transmitted; and

received-speech clarifying means for adjusting a gain for the received speech to be output to the speaker according to the level of the background sound measured by the background sound level measurement means.

5. The speech communication apparatus of Claim 4, wherein the microphone is a unidirectional or bi-directional microphone.

6. A speech communication apparatus according to Claim 4, further comprising

received-speech-level measurement means for measuring the level of a received-speech signal received in the speech communications,

wherein the background sound level measurement means measures the level of the background sound in each predetermined frequency band and the received-speech clarifying means performs loudness compensation in which the gain for the received-speech signal is adjusted in each predetermined frequency band

7. The speech communication apparatus according to Claim 4, wherein the speech communication apparatus is a portable, mobile telephone for performing the speech communications by radio communication.

8. A speech communication apparatus comprising:

a speaker;

a microphone;

a background sound microphone;

a transmission speech filter operable to reduce the level of a lower frequency component outputted by the microphone;

an adaptive filter operable to estimate speech signals outputted by the background sound microphone;

an adder operable to subtract the estimated speech signal from the output of the background sound microphone;

a background sound level calculator operable to calculate the level of the signal outputted from the adder and the level of the background sound;

a background sound level filter operable to minimize proximity effect; and

a received speech clarifying filter operable to adjust the gain for received speech according to the background sound level.

9. A speech communication apparatus according to Claim 8, further comprising transmission means for transmitting the output of the transmission-speech filter as a transmission-speech signal by the speech communications.

10. A speech communication apparatus for bi-directional speech communications, provided with a handset having at a front face a speaker for outputting received speech and a transmission-speech microphone for collecting speech to be transmitted, the speech communication apparatus comprising:

a background-sound microphone disposed at the rear face of the handset at almost the same height as the speaker, for collecting background sound;

background sound level measurement means for measuring the level of the output of the background-sound microphone as a background-sound level; and

received-speech clarifying means for adjusting a gain for received speech output to the speaker according to the background-sound level measured by the background sound level measurement means.

11. A speech communication apparatus of Claim 10, wherein the background-sound microphone is a unidirectional microphone.

12. A speech communication apparatus of Claim 10, further comprising received-speech-level measurement means for measuring, at each predetermined frequency band, the level of a received-speech signal received in the speech communications,

wherein the background sound level measurement means measures the level of the background sound in each predetermined frequency band, and

the received-speech clarifying means performs loudness compensation in which the gain for the received-speech signal is adjusted in each predetermined frequency band.

13. The speech communication apparatus of Claim 10 wherein the speech communication apparatus is a portable, mobile telephone for performing the speech communications by radio communication.

14. A speech communication apparatus for bi-directional speech communications, comprising:

a speaker for outputting received speech;

a microphone for collecting speech to be transmitted;

background sound level measurement operable to measure the level of background sound; and

received-speech clarifying section operable to adjust a gain for the received speech to be outputted to the speaker according to the level of the background sound measured by the background sound level measurement means,

the background sound level measurement calculator comprising:

a delay section operable to delay the output of the first background-sound microphone by the period corresponding to the delay time between transmission speech mixed into the output of the first background-sound microphone and transmission speech mixed into the output of the second background-sound microphone,

an adaptive filter operable to estimate transmission speech mixed into the output of the delay section,

an adder operable to subtract the transmission speech estimated by the adaptive filter from the output of the delay means, and

background sound level calculation section operable to calculate the level of the output of the subtracting means and for outputting the result as the level of the background sound.

15. The speech communication apparatus of to Claim 14, wherein the adaptive filter estimates the transmission speech according to the difference

between the output of the delay means and the transmission speech estimated by the adaptive filter.

16. A speech communication apparatus according to Claim 14, further comprising;

a received-speech-level measurement section operable to measure, at each predetermined frequency band the level of a received-speech signal received in the speech communications,

wherein the background sound level measurement section measures the level of the background sound in each predetermined frequency band, and

the received-speech clarifying section performs loudness compensation in which the gain for the received-speech signal is adjusted in each predetermined frequency band.

17. The speech communication apparatus of Claim 14, wherein the speech communication apparatus is a portable, mobile telephone for performing the speech communications by radio communication.

18. A speech communication method for bi-directional speech communications, comprising the acts of:

manipulating the frequency characteristic of the output of a microphone for collecting speech to be transmitted in order to diminish the proximity effect produced in the output of the microphone to extract speech to be transmitted from the output of the microphone;

measuring the level of background sound according to the extracted speech to be transmitted; and

adjusting a gain for received speech to be outputted to the speaker according to the measured level of the background sound.

19. The speech communication method of Claim 18, wherein the microphone is a unidirectional or bi-directional microphone.

20. The speech communication method of Claim 18, further comprising the act of measuring, at predetermined frequency band, the level of a received-speech signal received in the speech communications,

wherein the level of the background sound is measured in each predetermined frequency band, and loudness compensation is performed in which the gain for the received-speech signal is adjusted in each predetermined frequency band, and the resultant signal is outputted to the speaker as the received speech.